



The Polish Road to Optical Networks

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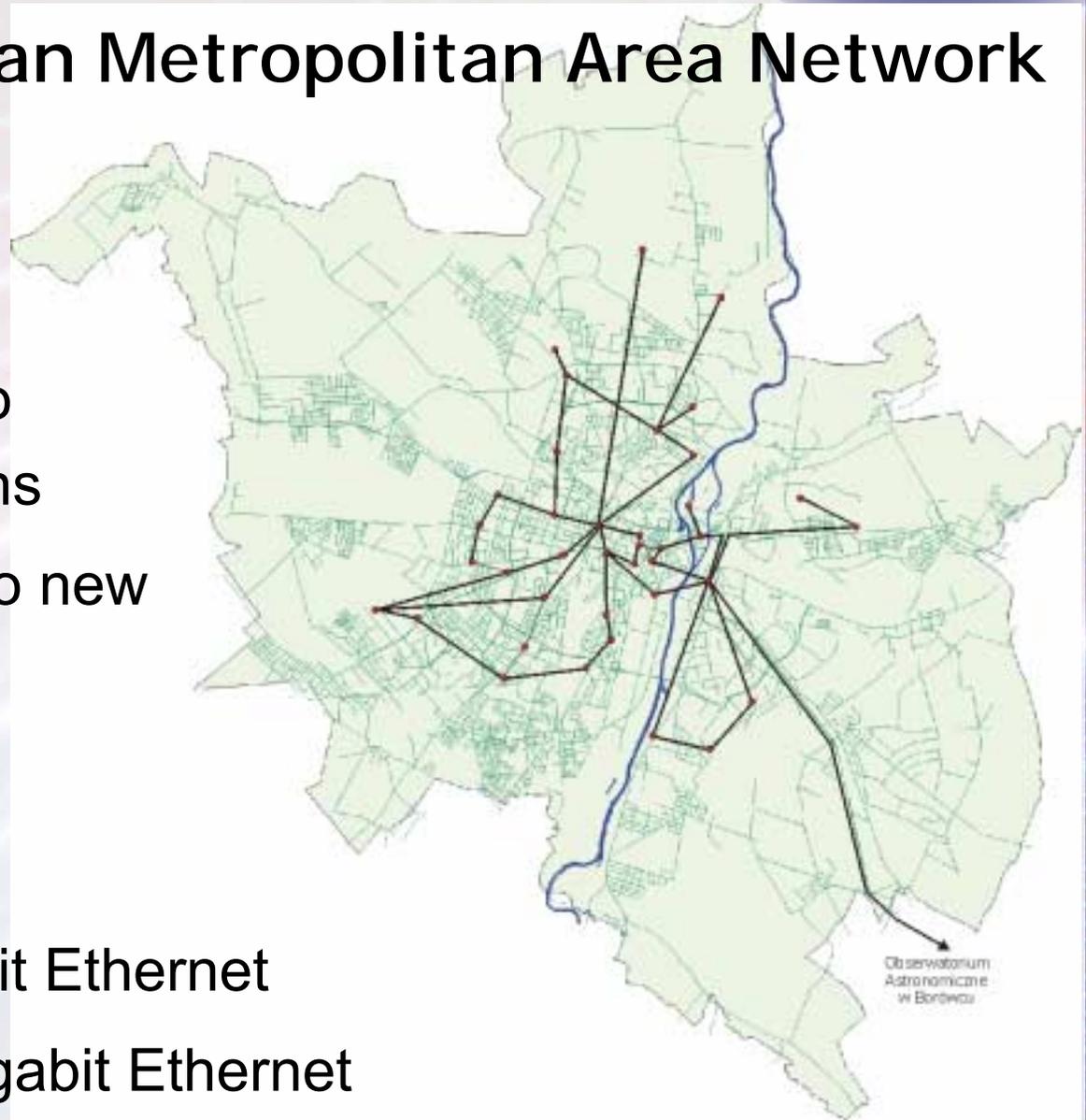
Pisa, 10-12.05.2005

National programs of development IT infrastructure for academic community

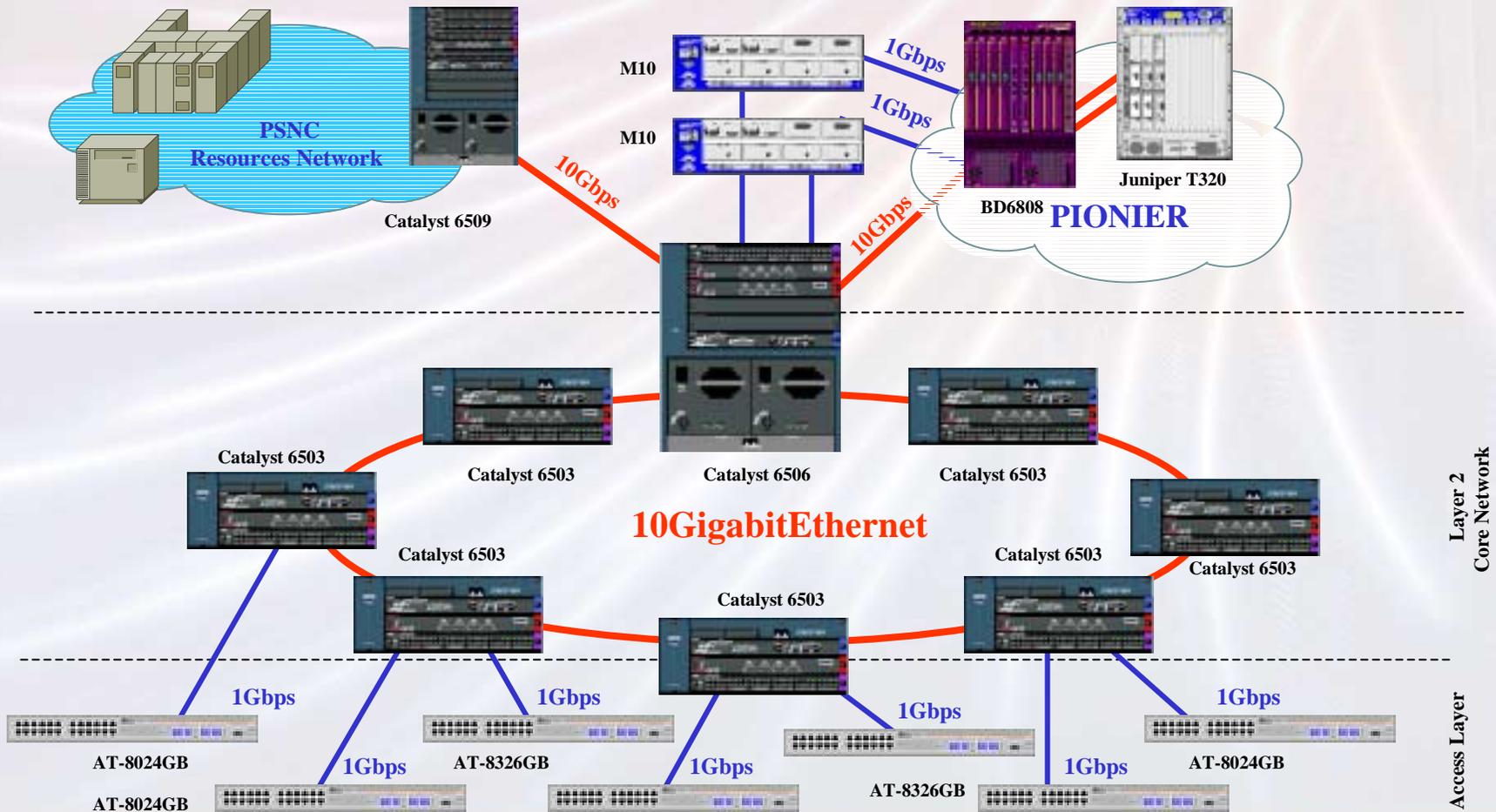
- State Committee of Scientific Research created the national program of development IT infrastructure in 1992-2000:
 - ▶ 21 Metropolitan Area Networks
 - ▶ 5 High Performance Computing Centers
 - ▶ National Network (NASK, POL-34/155/622)
 - ▶ LANs and campus networks in research institutions
 - ▶ Resource servers and databases in MANs

POZMAN – Poznan Metropolitan Area Network

- Own fiber network (under 220 km)
- 105 connections to research institutions
- Simple migration to new technologies
 - 1992 - FDDI
 - 1995 - ATM
 - 2000 - Gigabit Ethernet
 - 2005 - 10 Gigabit Ethernet



POZMAN Metropolitan Area Network



HPC centers in Poland

PSNC:

SGI Origin3800 (MIPS R12k/160),
Cray SV1/8,
Cluster PC (IA-64/250),
SunFire 6800 (UltraSPARCIII/48),
SGI Onyx2 (MIPS R16k/8, Infinity Reality Engine),
SGI Altix

ACK Cyfronet:

SGI Origin2000 (MIPS R14k/128),
HP Integrity Superdome (IA-64/8),
SunFire 6800 (UltraSPARCIII/20),
Cluster PC (Intel PentiumIII, Xeon/80),
Cluster PC (IA-64/40).

TASK:

Cluster PC (IA-64/256),
Cluster PC (IA-32/Xeon/128).

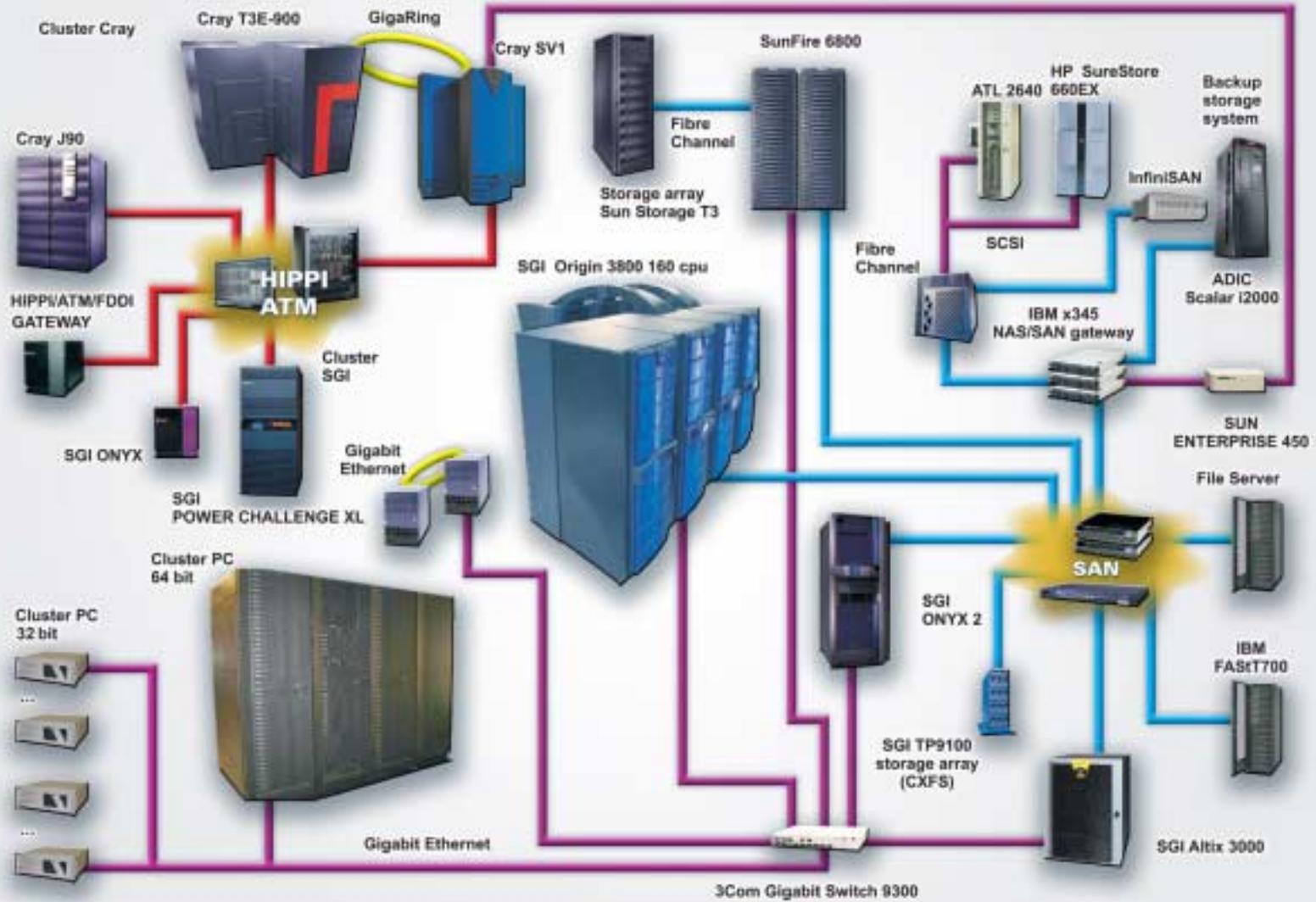
ICM:

Cray SV1ex (32),
SGI Origin2000 (MIPS R14k/16),
SUN E10K (UltraSPARC/16)

WCSS:

SGI Origin2400 (MIPS R14k/32),
Cluster PC (Xeon/58).

Poznan HPCC resources



PIONIER – the new program of development IT infrastructure in Poland

- Period: 2000 – 2006
- PIONIER is infrastructure for e-Science and new common research areas
 - Support European Research Area
 - Environment for efficient implementation i.e.:
 - Computing and visualisation GRIDs
 - Virtual laboratories
 - Communication and collaborative workgroup systems
 - Digital libraries
 - Infrastructure on highest world quality level



PIONIER - the economy behind...

Cost relation (connections between 21 MANs, per year):

- 622Mb/s channels (**real cost paid to TELCO**) : 4.8 MEuro
- 2.5Gb/s channels from telco (estimate) : 9.6 MEuro
- 10Gb/s channels from telco (estimate) : 19.2 MEuro

PIONIER costs (5200km of fibers, 10GE) : 55.0 MEuro

Annual PIONIER maintenance costs : 2.1 MEuro

Return of Investment in 3 years!

(calculations made only for 1 lambda used)

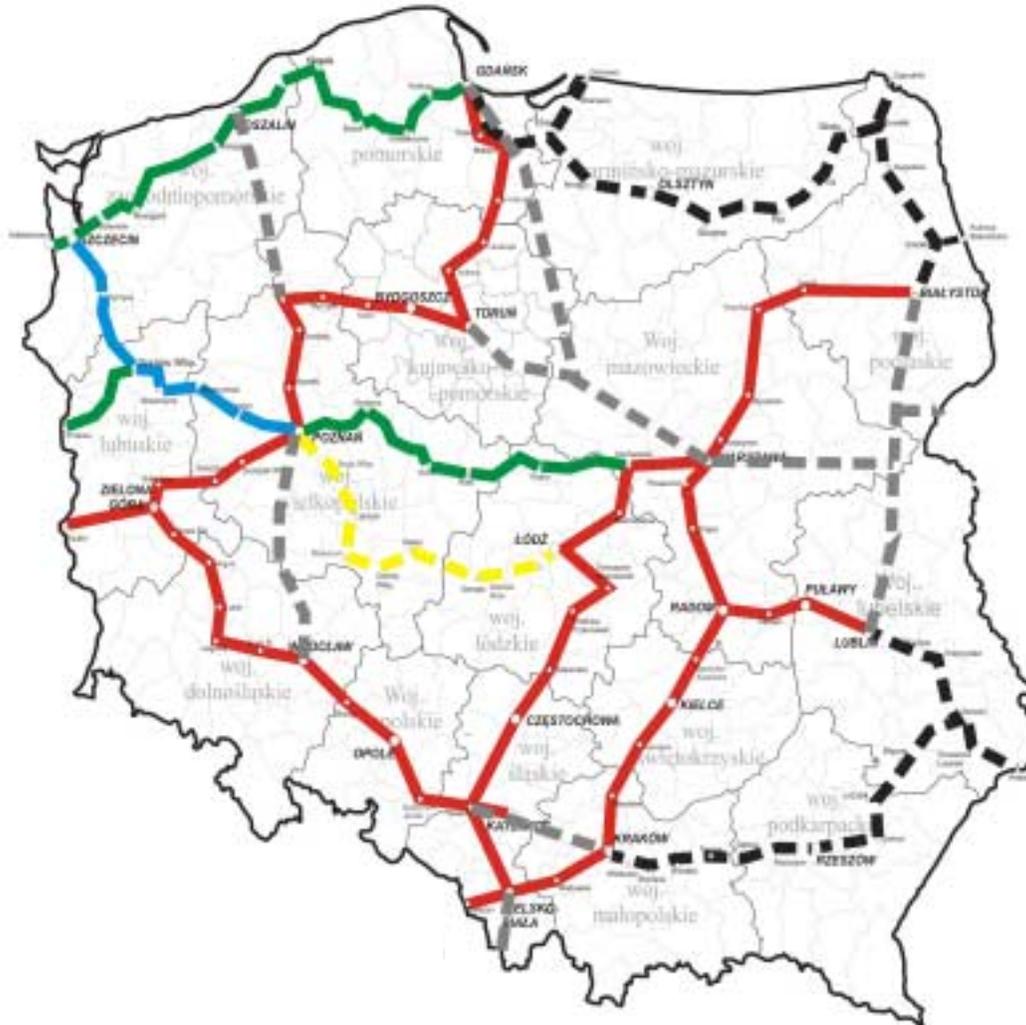
Budget for all R&D activities for Poland in 2004

697.8 MEuro – 0,34 %PKB

PIONIER - an idea of „All Optical Network”, facts:

- 4Q1999 – proposal of program submitted to KBN
- 2Q2000 – PIONIER testbed (DWDM, TNC 2001)
- 3Q2000 – project accepted (tender for co-operation, negotiations with Telcos)
- 4Q2001 – I Phase: ~10 mln Euro
 - Contracts with Telbank and Szeptel (1434 km)
- 4Q2002 – II Phase: ~18.5 mln Euro
 - Contracts with Telbank, regional Power Grids Companies (1214 km)
 - Contract for equipment: 10GE&DWDM and IP router
- 2H2003 – installation of 10GE with DWDM rep./amp.
 - 16 MANs connected and 2648 km of fibers installed
 - **20 October 2003 – PIONIER is operational**
 - Contracts with partners (1426 km):
 - I phase ~ 5 mln Euro
- 3Q2004 - public tender for new links 1119km (budget ~ 1 mln Euro)
 - II phase ~ 10 mln Euro to complete 1426 km fibers
- **2005/2006 – 21 MANs connected with ~5200 km of fiber**

Fibers links in PIONIER



- Installed fiber
- PIONIER nodes
- Fibers+pipes (end of 2005)
- Fibers+pipes (end of 2006)
- Fibers+pipes planned

PIONIER - technology

Different fiber types for various applications

- SMF (Standard Mode Fiber, G.652, general purpose – regional and national; used currently for 10GE transmission)
- NZDSF (Non-Zero Dispersion Shifted Fiber, G.655, future long range multi-lambda 40Gbit/s transmission for direct HPC connection and ultra-broadband Internet)

Guaranteed flexibility

- average span length 60km for national backbone (allows for different class of equipment to be used – Metro, LH, ULH...)

Safe technology

- most of our installations are underground, 830km OPGW+ADSS (high voltage power lines, ground wire) with tight SLA.

Problems

- local loop construction is sometimes difficult (urban area - average 6 months waiting time for permissions)

Building 10GE transmission

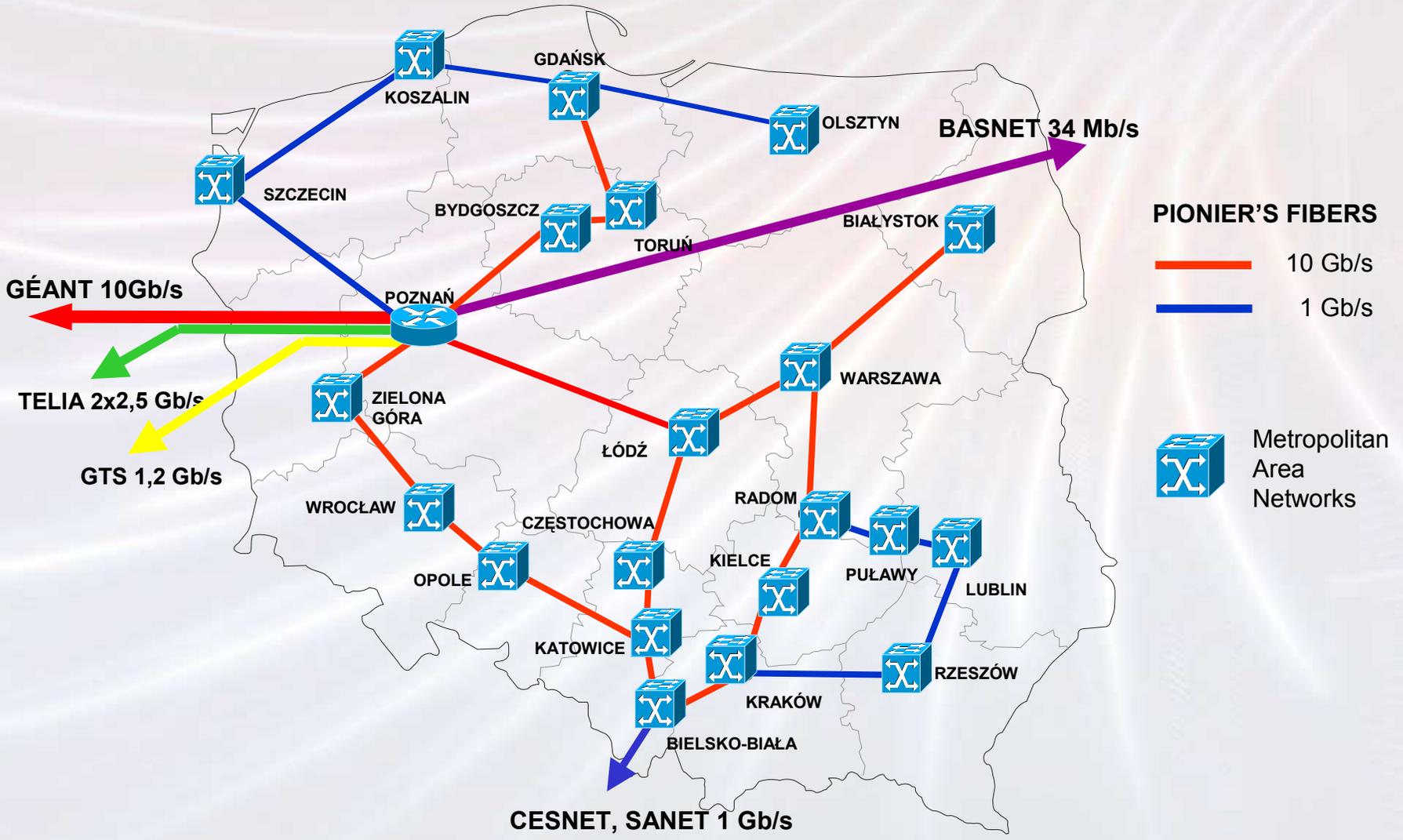
2003 - 10GE transmission

- the need to reduce operational costs
- needs from VLBI and CERN for high bandwidth links
- an intermediate solution until target 40Gbit/s DWDM system is installed

Equipment

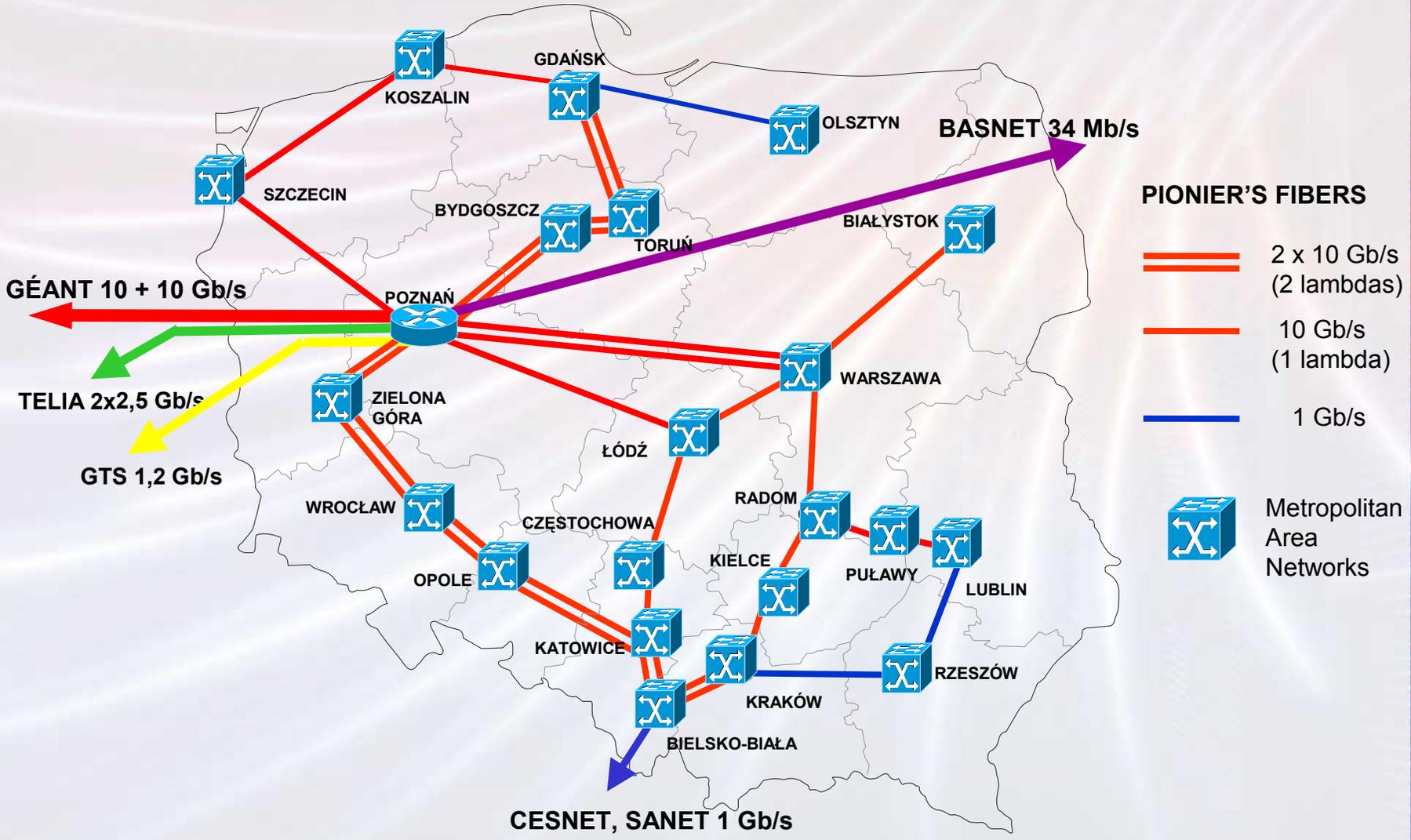
- no appropriate 10GE switch interface/line amplifier found
- transport on DWDM from ADVA / INRANGE
- Black Diamond 10GE switches used as core equipment
- Juniper T320 for international connectivity and VLAN routing

PIONIER network 1Q2005

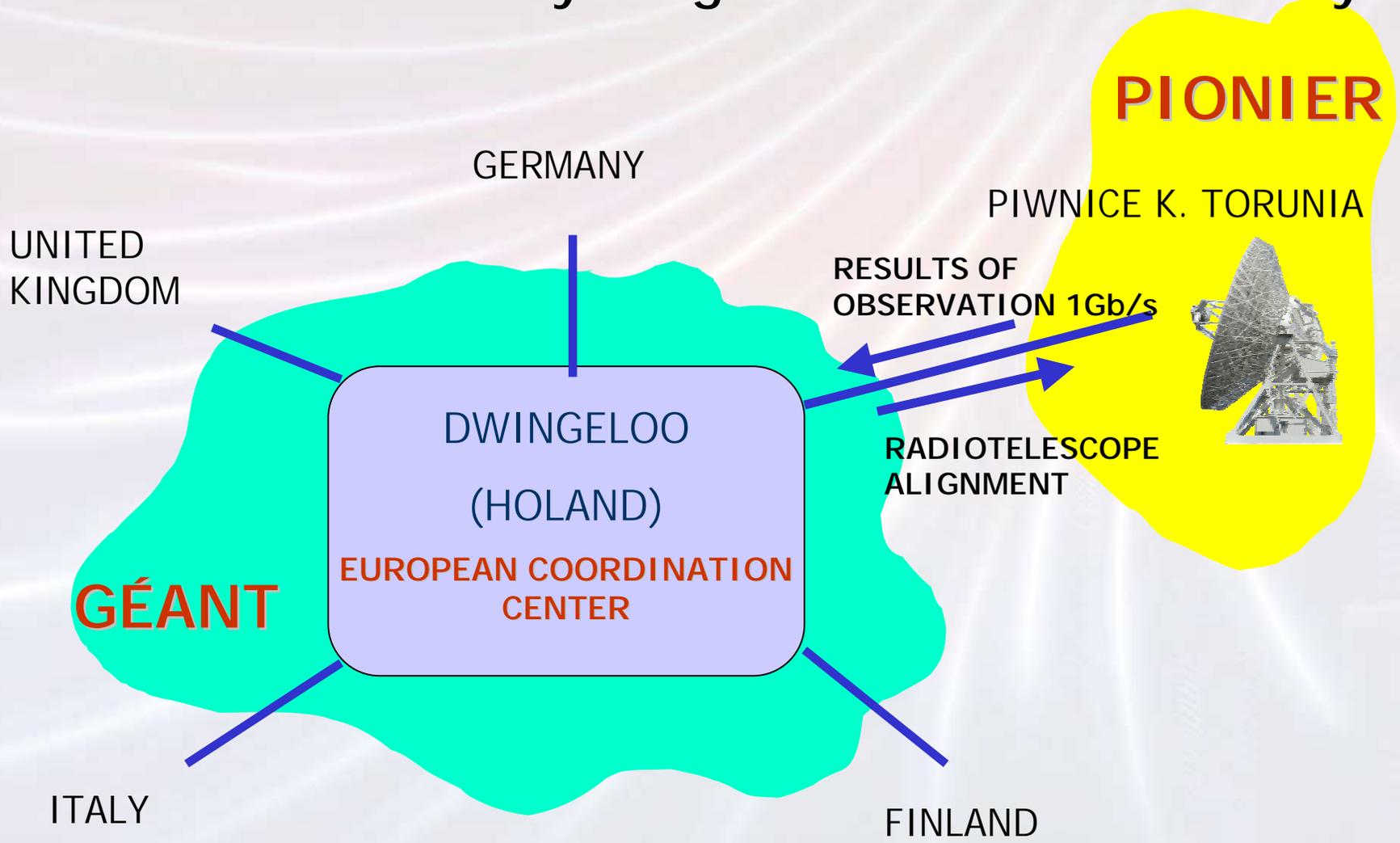




PIONIER network 4Q2005

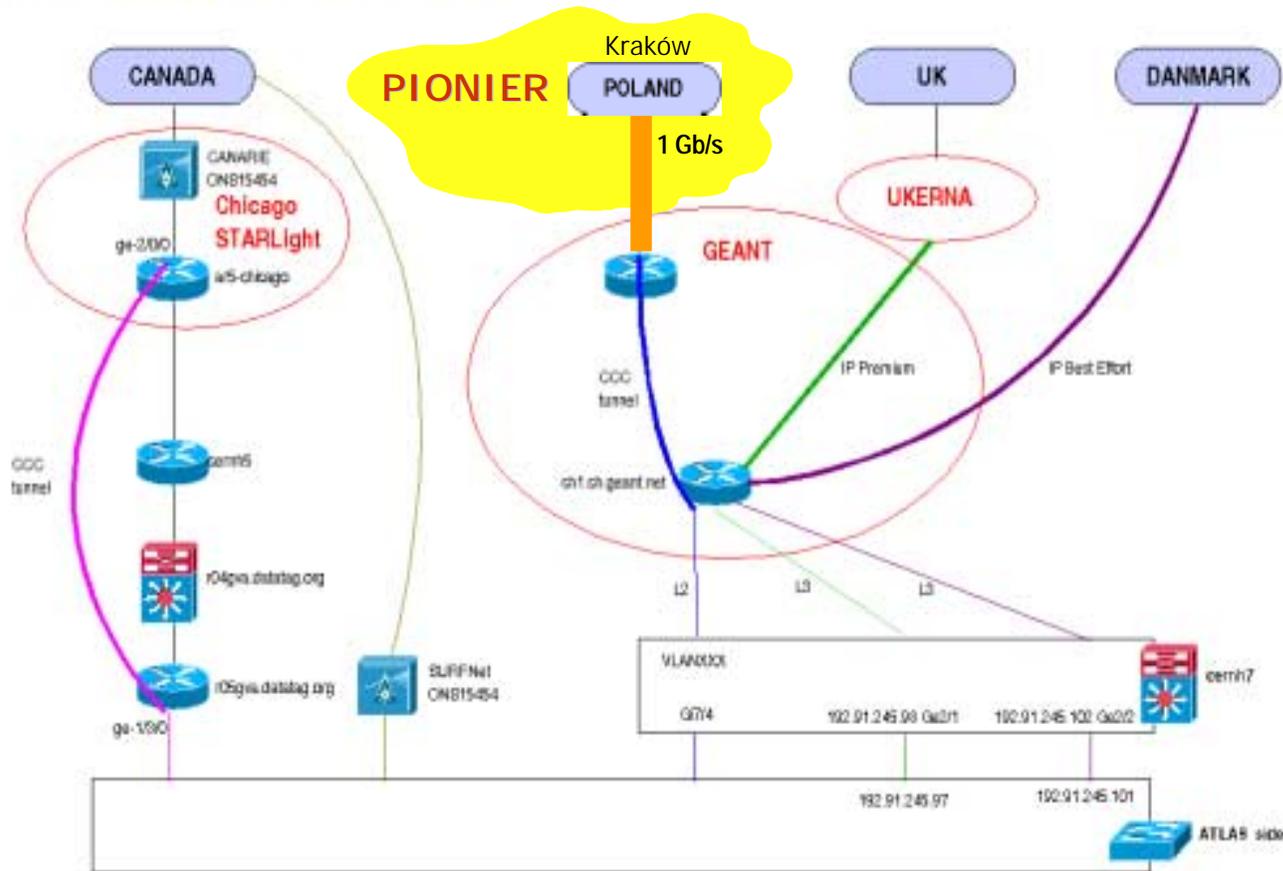


VLBI PROJECT: Very Long Baseline Interferometry



ATLAS PROJECT

ATLAS remote farms – network connectivity



The future of PIONIER

How to make future-proof investments?

- each of new fiber routes will be equipped with 2 pipes – new fibers can be added if needed
- 1426 km, 2x40mm pipes with 6xG.655+18xG.652 fibers contracted in 2003
- 1119 km, 2x40mm pipes with 6xG.655+18xG.652 fibers contracted in 2004
- next 1000 km in plans

PIONIER-based regional networks development

- Interconnection of remote universities – possibility to create new MANs
- 16 provinces prepare the regional network deployment

Interconnection to neighbouring networks

- Cross Border Dark Fiber
- Porta Optica

Regional Network for Wielkopolska Province

Who we want to connect

- 2289 schools
- 761 libraries
- 222 communes

Technologies

- 2 455 km of fibre
- 10 GE and GE switches
- WiFi/WiMAX as access

Costs

- total: 25 mln Euro
- possibility of refund – 75% from EC structural funds



PIONIER Cross Border Dark Fiber locations



Active CBDF links and NRENs' own fibers in CE



CBDF results

- Relatively easy installation (@ 1Gbit/s) – 120km LH coloured GBICs
- One technology - PIONIER, CESNET, ACONET & SANET operate with 10GE/GE
- Quite difficult coordination of the management procedures:
 - Link troubleshooting
 - VLAN assignment (how to find a VLAN which is free in all NRENS?)
 - Coordination of configuration tasks
 - Free of charge model is limited by the finite bandwidth of partners
 - Incentives for installation of additional channels?

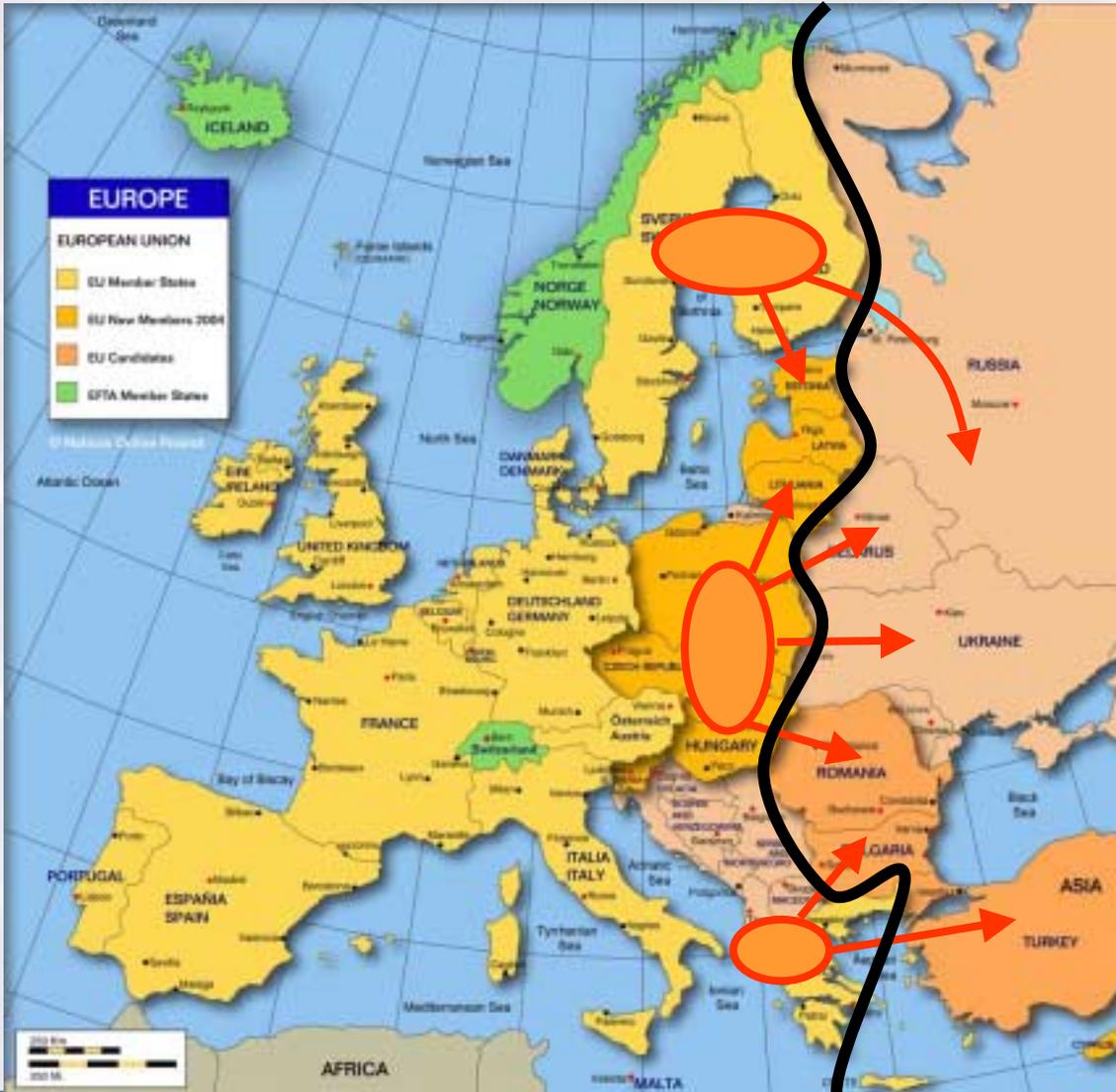
„Porta Optica – a distributed optical gateway from GEANT to EE”

- A chance for closer scientific collaboration by the means of providing multichannel/multilambda Internet connections between neighboring countries of CE/EE.
- An easy way to extend GEANT to Eastern European countries – a true, future-proof dark fiber connectivity for whole Europe.

Where is the digital divide?



„Porta Optica – a coordinated task...



What Porta Optica can offer ?

- Dedicated dark fiber connectivity (with diverse route) from every eastern neighbour of Poland to GEANT PoP in Poland
- Dedicated lambda connectivity (with diverse route), as above
- Know-how and support

What has been done?

- PIONIER prepared for interconnection of EE countries (CBDF)
- Intensive talks and common preparations for NRENs interconnection – running connection to Belarus (34Mbit/s)
- CBDF ideas are being verified in PIONIER/CESNET/SANET/ACONET interconnection
- Porta Optica Study proposal has been prepared and submitted in the last call, as an integration of latest SEEFIRE/GEANT/PIONIER ideas on network construction for the support of EE countries.
 - *„The ultimate goal of PORTA OPTICA STUDY is the creation and further development of communication network and consolidation of the initiatives to ensure the successful, fiber optics-based research network deployment in the Eastern Europe , Baltic states and Southern Caucasus regions” - SSA*



Questions?